Jurassic Period

{jur-as'-ik}

The Jurassic Period, from about 190 to 135 million years ago, is the middle division of the MESOZOIC ERA of geologic time. The name, introduced (1829) by the French geologist Alexandre BRONGNIART, refers to the chalk sequence in the rock strata of the Swiss-French Jura Mountains. Stratigraphers have subdivided the Jurassic system into the following stages, in order of increasing age: (Upper Jurassic) Portlandian, Kimeridgian, Oxfordian, and Callovian; (Middle Jurassic) Bathonian and Bajocian; and (Lower Jurassic) Aalenian, Toarcian, Pliensbachian, Sinemurian, and Hettangian.

PALEOTECTONICS AND GEOGRAPHY

At the beginning of the Jurassic Period, the various parts of the supercontinent of Gondwanaland--South America, Africa, India, Antarctica, and Australia--were still connected to one another. They remained so until the Late Jurassic (160 to 135 million years ago), when CONTINENTAL DRIFT began to rift them apart. A vast, shallow sea, the Tethys, separated Gondwanaland from the protocontinents of Europe and Asia at this time.

Great thicknesses of marine sediments were accumulating in belts of sinking crust (geosynclines), one of which, occupied by the Tethys Sea, extended from the Mediterranean to Iran, the Himalayas, and Indonesia. In the Alpine, or Northern Tethyan geosyncline, thicknesses of Jurassic sediment, containing a large variety of facies, were deposited. (Jurassic facies patterns are complex, and changes in thickness are commonly abrupt.) The geology of the Alpine region became further complicated by normal faulting, which produced a complex pattern of uplifted and downwarped blocks. Within the central and western areas of the Tethyan geosyncline, thick sequences composed primarily of marine facies were deposited. In central Iran, however, significant nonmarine strata have been found, indicating tectonic activity there.

In the circum-Pacific geosynclinal belt, graywacke, shale, siliceous sediments, and volcanics, rocks characteristic of eugeosynclines, were deposited. In some places the deposits accumulated to thicknesses of several thousand meters. A geosynclinal belt extended across northeast Siberia, where detrital sediments were deposited.

Shallow seas spreading from the Tethys, the Arctic, and the Atlantic invaded much of northwest Europe early in Jurassic time but retreated by the close of the period. In the Indian Ocean, shelf seas occupied the coastal region of eastern Africa and the western half of Madagascar. Shelf seas also occupied various embayments in western Australia.

In North America, shallow marine transgressions originating from the Arctic Ocean covered the present area of the Rocky Mountains, eventually reaching as far south as Utah. These seas had completely retreated by the end of the Jurassic. The Gulf of Mexico formed during this period, a fact indicated by the presence of Jurassic marine rocks in the southern United States, eastern Mexico, and northern Central America.

In western North America, PLATE TECTONICS triggered an orogeny as the eastern Pacific plate, driven under the American plate along a subduction zone, exerted compressional forces that deformed the geosynclinal belt of western Nevada, producing the Sierra Nevada. This orogeny, accompanied by intrusion of batholiths, affected a great belt extending northward through British Columbia and central Alaska.

Worldwide orogenic (mountain-building) activity increased significantly over that of the preceding Triassic and heralded the intense activity of the Cretaceous. The Crimea and the Caucasus underwent orogenesis. Much of China was affected by some form of diastrophism during the Jurassic. New Zealand underwent final orogenesis in the Late Jurassic, as did the geosynclinal belt extending across northeast Siberia.

With few exceptions, Jurassic climates seem to have been remarkably equitable. In the western United States, arid conditions are indicated by thick deposits of dune sand, which accumulated, especially in Utah, before transgression of the inland sea from the north. No evidence of Jurassic glaciation has been found.

Jurassic plant fossils of worldwide distribution and widespread coal deposits are evidence of a moist climate that was probably warmer and more uniform than at present, although from studying the growth rings on fossil trees, experts have determined that seasons did exist.

Jurassic rocks have yielded moderate amounts of mineral resources, including iron ore and petroleum in western

Jurassic Period

(geology)

The Jurassic Period, from about 190 to 136 million years ago, is the middle division of the MESOZOIC ERA of geologic time. The name, introduced (1829) by the French geologist Alexandre Brongniart, refers to the chalk sequence in the rock strata of the Swiss-French Jura Mountains. Geologists have subdivided the Jurassic system into the following stages, in order of increasing age: Upper Jurassic: Portlandian, Kimmeridgian, Oxfordian, and Callovian; Middle Jurassic: Bathonian and Bajocian; and Lower Jurassic: Aalenian, Toarcian, Pliensbachian, Sinemurian, and Hettangian.

PALEOTECTONICS AND GEOGRAPHY

At the beginning of the Jurassic Period, the various parts of the supercontinent of Gondwanaland—South America, Africa, India, Antarctica, and Australia—were still connected to one another. They remained so until the Late Jurassic (150 to 136 million years ago), when CONTINENTAL DRIFT began to split them apart. A vast, shallow sea, the Tethys, separated Gondwanaland from the protocontinents of Europe and Asia at this time.

Great thicknesses of marine sediments were accumulating in basins or linear troughs (geosynclines), one of which, occupied by the Tethys Sea, extended from the Mediterranean to Iran, the Himalayas, and Indonesia. In the Alpine or Northern Tethyan geosyncline, thicknesses of Jurassic sediments containing a large variety of facies were deposited. (Jurassic facies patterns are complex, and changes in thickness are common as well.) The geology of the Alpine region became further complicated by normal faulting, which produced a complex pattern of uplifted and downdropped blocks. Within the central and western parts of the Tethyan geosyncline, thick sequences composed primarily of marine facies were deposited. In central Iran, however, Jurassic nonmarine strata have been found, indicating tectonic activity there.

In the circum-Pacific geosynclinal belt, graywackes, shale, siliceous sediments, and volcanic rocks characteristic of eugeosynclines were deposited. In some places the deposits accumulated to thicknesses of several thousand meters. A great shallow shelf extended across European Russia, where [illegible] were deposited.

Shallow seas spreading from the Tethys, the Arctic, and the Atlantic invaded much of northwest Europe early in Jurassic time but retreated by the close of the period. In the Indian Ocean, shallow seas occupied the coastal region of eastern Africa and the western half of Madagascar. Shallow seas also occupied various embayments in western Australia.

In North America, shallow marine transgressions originating from the Arctic Ocean covered the present area of the Rocky Mountains, eventually reaching as far south as Utah. These seas did not completely retreat until the end of the Jurassic. The Gulf of Mexico formed during this period, a fact indicated by the presence of Jurassic marine rocks in the southern United States, eastern Mexico, and northern Central America.

In western North America, PLATE TECTONICS triggered an orogeny as the eastern Pacific plate, driven under the American plate along a subduction zone, exerted compressional forces that uplifted the geosynclinal belt of western Nevada, producing the Nevadan orogeny. This orogeny, accompanied by intrusion of batholiths, affected a great belt extending northward through British Columbia and central Alaska.

Worldwide orogenic (mountain-building) activity increased in intensity over that of the preceding Triassic and heralded the intense activity of the Cretaceous. The Cimmerian and the Caucasian were important orogeneses. Much of Siberia was affected by some form of diastrophism during the Jurassic. New Zealand underwent the orogenesis in the Late Jurassic, as did the geosynclinal belt extending across northeast Siberia.

With few exceptions, Jurassic climates seem to have been warm and temperate. In the western United States, arid conditions are indicated by thick deposits of dune sand, which accumulated, possibly in Utah, before transgression of the inland sea from the north. No evidence of Jurassic glaciation has been found.

Jurassic plant fossils discovered in Antarctica and widespread coal deposits are evidence of a moist climate that was probably warmer and more uniform than at present. Although [illegible] studying the growth rings on fossil trees, scientists have determined that seasons did exist.

Jurassic rocks have yielded moderate amounts of [illegible], including [illegible] and petroleum in [illegible]

Europe and coal in Scotland and Greenland. Petroleum is also obtained from Jurassic rocks in North America, Morocco, and Saudi Arabia.

LIFE

The FOSSIL RECORD clearly shows that the Jurassic was a time of great abundance and diversity of life. In contrast to the Triassic, nearly all major invertebrate fossil groups exist in a great diversity of forms. The dominant invertebrate group, the ammonites, had a great resurgence after nearly becoming extinct at the close of the Triassic. The Jurassic was also a time of especially marked development and modernization of the bivalved mollusks.

The vertebrate life of the Jurassic consisted primarily of reptiles. The most famous, the DINOSAURS, were land animals. Some of the most famous dinosaur fossils have come from the Morrison Formation, a sequence of freshwater sediments deposited in Utah, Colorado, Wyoming, and Montana. Among other Jurassic reptiles were the turtles and crocodiles, which first appeared during the period, and the large, sea-dwelling Ichthyosaurs (see ICHTHYOSAURUS) and PLESIOSAURS.

The last environmental domain uninhabited by the vertebrates was the air. This changed in the Jurassic with the appearance of the PTERODACTYLS and other pterosaurs (flying reptiles). The first bird, ARCHAEOPTERYX, also appeared during this time. Mammals, which first appeared in the Late Triassic, diversified into at least five orders during the Jurassic.

Jurassic plants were surprisingly uniform throughout the world. The principal types of flora were the CYCADS (the most characteristic type), ginkgoes, conifers, and ferns.

Bernhard Kummel

Bibliography: Arkell, W. J., Jurassic Geology of the World (1956); Eicher, Don L., and McAlester, A. Lee, History of the Earth (1980); Hallam, A., Atlas of Paleobiogeography (1972) and Jurassic Environments (1975); Kummel, Bernhard, History of the Earth, 2d ed. (1970); McKee, E. D., et al., Paleotectonic Maps of the Jurassic System (1956); Seyfert, Carl K., and Sirkin, Leslie A., Earth History and Plate Techtonics (1979); Smith, Peter J., ed., The Earth (1986).

See also: EARTH, GEOLOGICAL HISTORY OF; EVOLUTION; PALEOGEOGRAPHY.